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Table I: Characteristics of Studies:

Study	Size (n)	Population	Exclusion	Study Design	Delirium Incidence (%)	Delirium Assessment Tool	Testing	Country	Age	NOS
Benoit 2005	102	Aortic aneurysm repair	Hearing/Visual Impairment	Prospective Cohort	34	DSM IV/DOS	Symptom driven	Canada	71 (8)	7
Bohner 2003	153	Elective	>24 hrs ventilator	Prospective Cohort	39.2	DSM IV/DRS	Daily	Germany	66 (10)	8
Bryson 2011	84	Elective open aortic aneurysms (Age>60)	Dementia/psych illness, substance abuse	Prospective Cohort	36	CAM	Day 2,4, and discharge	Canada	71 (6)	7
Ellard 2014	500	Open aneurysms and carotid endarterectomy excluded	Dementia, abnormal consciousness	Retrospective Cohort	19.4	NEECHAM	Daily	Canada	72 (12)	5
Katznelson 2009	582	Carotid endarterectomy excluded	Dementia, abnormal consciousness, short admission (<24 hours), multiple procedures	Prospective Cohort	22	NEECHAM	Daily	Canada	68 (12)	8
Koebrugge 2010	107	Aorto-illiac surgery	Dementia	Prospective Cohort	23	DSM-IV, DOS	3 x daily	Netherlands	69 (10)	7
Pol 2011	142	All Vascular Surgery	None	Prospective Cohort	7	DSM-IV-TR, DOS	Symptom driven	Netherlands	68 (11)	6

Pol 2014	277	Carotid endarterectomy excluded	None	Prospective Cohort	6	DSM-IV-TR, DOS	Symptom driven	Netherlands	69 (11)	6
Raats 2015	206	Ward patients	Short admission (<48 hours)	Prospective Cohort	15.5	DOS	3 x daily	Netherlands	73 (9)	6
Salata 2012	256	Aortic aneurysm repair	Dementia, abnormal consciousness	Retrospective Cohort	22	NEECHAM	Daily	Canada	71 (10)	6
Sasajima 2000	110	Lower limb ischemia (Age>60)	None	Prospective Cohort	29.1	CAM	Daily	Japan	72 (7)	7
Sasajima 2012	299	Lower limb ischemia (Age>60)	None	Prospective Cohort	29	CAM, DRS	Symptom driven	Japan	72 [10]	7
Schneider 2002	47	Elective only	Short operations (<90mins)	Prospective Cohort	36	DSM IV, DRS	Daily	Germany	67 (7)	8
Sugimoto 2015	397	Open aortic aneurysm repair	None	Retrospective Cohort	11.5	DSM IV	Symptom driven	Japan	72 [10]	8
Van Eijsden 2015	92	Lower limb ischemia	None	Retrospective Cohort	32	DOS, DSM IV	3 x daily	Netherlands	76 [11]	7
Visser 2015	463	All vascular surgery (Age>60)	Endovascular without stenting, short/no hospital admission	Prospective Cohort	4.8	DSM IV, DOS	3 x daily	Netherlands	72 [11]	7
Totals	**3817**				**23.4**					

Table I: Characteristics of Studies: DSM - Diagnostic and Statistical Manual of Mental Disorders, CAM - Confusion Assessment Method, NEECHAM - NEECHAM Confusion Scale, DRS - Delirium Rating Scale, DOS - Delirium Observation Scale, NOS – Newcastle Ottawa Scale. Incidence reflects unweighted cumulative sum.

Table II: Newcastle-Ottowa Scoring

	Benoit 2005	Bohner 2003	Bryson 2011	Ellard 2014	Katznelson	Koebrugge 2010	Pol 2011	Pol 2014	Raats 2015	Salata 2012	Sasajima 2000	Sasajima 2012	Schneider 2002	Sugimoto 2015	Van Eijsden	Visser 2015
Selection																
Representativeness of exposed cohort	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Selection of non-exposed cohort	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ascertainment of exposure	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Demonstration outcome of interest not present at start of study			+		+											
Comparability																
Study controls for age	+	+			+	+	+	+	+	+	+	+	+	+	+	+
Controls for additional factor	+	+			+	+	+	+	+	+	+	+	+	+	+	+
Outcome																
Assessment of outcome	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Length of follow-up	+	+	+	+	+						+	+	+	+	+	
Adequacy of cohort follow-up		+	+			+							+	+		+
Score	7	8	7	5	8	7	6	6	6	6	7	7	8	8	7	7

Table II: Newcastle Ottawa Scoring

Table III: Significant Risk Factors in Multivariate Models.

Risk Factors	**Study**	**OR (95% CI) / [SE] / *b**	**P**
Patient Factors			
Absence of High Lipids	Sugimoto 2015	2.15 (1.06 to 4.37)	.034
Age	Katznelson 2009	1.04 (1.02 to 1.07)	<.001
Age	Salata 2012	1.04 (1.00 to 1.08)	.04
Age>64	Bohner 2003	3.03 [SE 0.47]	.018
Age≥70	Sasajima 2000	14.1 (2.7 to 72.0)	.002
Age≥72	Sasajima 2000	5.1 (2.8 to 10.7)	<.0001
Age≥70	Sugimoto 2015	3.34 (1.44 to 7.77)	.005
Age≥80	Visser 2015	7.3 (1.8 to 30.1)	.006
Amphia Risk score	Raats 2015	1.77 (1.04 to 3.02)	.04
Cognitive Impairment	Visser 2015	16.4 (4.7 to 57.0)	<.001
CRP>5	Pol 2014	1.01 (1.00 to 1.03)	.04
Current smoker	Visser 2015	10.5 (2.8 to 40.2)	.001
Diabetes	Van Eijsden 2015	6.23 (1.11 to 52.2)	.035
Depression	Katznelson 2009	3.56 (1.53 to 8.28)	.003
End Stage Renal Failure	Sasajima 2000	5.0 (1.9 to 13.0)	.001
HDS-R≥20	Sasajima 2000	2.8 (1.4 to 5.6)	.003
Height <170cm	Bohner 2003	3.95 [SE 0.47]	.004
History of CVA/TIA	Katznelson 2009	2.64 (1.57 to 4.45)	<.001
History of major amputation	Bohner 2003	24.4 [SE 0.95]	.001

Hypertension	Visser 2015	7.6 (1.9 to 30.5)	.004
MMSE	Schneider 2002	-0.08*	.0007
MMSE <25	Bohner 2003	28.0 [SE 0.93]	.001
No history of supra-aortic occlusive disease	Bohner 2003	6.73 [SE 0.60]	.001
Nurse help pre admission	Raats 2015	3.61 (1.13 to 11.49)	.03
Pre op Beta Blocker	Katznelson 2009	2.06 (1.18 to 3.60)	.011
Pre op Statin	Katznelson 2009	0.56 (0.37 to 0.88)	.011
SNAQ-RC≥3	Van Eijsden 2015	5.55 (1.07 to 42.0)	.039
Peri-Operative Factors			
Amputation	Katznelson 2009	4.66 (1.96 to 11.09)	<.001
Aortic reconstruction	Katznelson 2009	5.34 (2.54 to 11.20)	<.001
Blood Loss≥1517ml	Sugimoto 2015	2.71 (1.36 to 5.39)	.005
Critical Limb Ischemia (vs. Claudication)	Sasajima 2000	2.0 (1.1 to 3.6)	.034
Infusion	Schneider 2002	0.0001*	.0094
Intra op colloid >800ml	Bohner 2003	2.62 [SE 0.46]	.035
Intra op minimal potassium <3.5mmol/L	Bohner 2003	3.18 [SE 0.50]	.021
Multiple segment occlusion	Sasajima 2000	2.9 (1.6 to 5.3)	<.0001
Open Vs EVAR	Salata 2012	0.32 (0.16 to 0.73)	.005
Thrombectomy/Embolectomy	Katznelson 2009	3.27 (1.41 to 7.60)	.006
Transfusion	Schneider 2002	0.0005*	.0069

Type of procedure	Visser 2015	14.0 (3.9 to 49.8)	<.001
Post-Operative Factors	**None**		

*Table III: Summary of Risk factors analysed in multivariate models. *b – Parameter estimated from multiple regression analysis.*

MMSE – Mini Mental State Examination, SNAQ-RC – Short Nutritional Assessment Questionnaire (version for elderly inpatients), CVA-Cerebrovascular accident, TIA-Transient ischemic attack. HDS-R - Hierarchic Dementia Scale-Revised.

Table IV: Meta-Analysis of Risk Factors (Minimum 4 studies)

Outcome or Subgroup	**Studies**	**Participants**	**Statistical Method**	**Effect Estimate OR [95%CI] /*MD(95%CI)***	**I^2**
Patient Factors					
ASA>2	5	1180	M-H, Fixed	*3.44 [2.02, 5.87]	49%
Diabetes Mellitus	7	2149	M-H, Random	1.40 [0.86, 2.27]	69%
eGFR<60	5	1180	M-H, Fixed	*2.09 [1.23, 3.56]	0%
History of stroke/TIA	4	1552	M-H, Fixed	*1.87 [1.31, 2.67]	48%
Hypercholesterolaemia	4	848	M-H, Fixed	*0.40 [0.27, 0.59]	0%
Hypertension	7	2149	M-H, Random	1.50 [0.94, 2.39]	48%
Male	11	2777	M-H, Fixed	*1.30 [1.01, 1.67]	0%
Mean Age	*10*	*2226*	*IV, Fixed*	**4.99 (4.02, 5.95)*	*0%*
Neurological Comorbidity	4	699	M-H, Fixed	*1.57 [1.06, 2.31]	0%
Peri-operative Factors					
General Anaesthesia	5	1461	M-H, Fixed	0.94 [0.69, 1.29]	46%

Length of Op (min)	*4*	*472*	*IV, Fixed*	*16.09 (-0.98, 33.17)*	*48%*
Mean Pre-operative Hb (g/dL)	*4*	*889*	*IV, Fixed*	**-0.66 (-0.98, -0.33)*	*0%*
Post-operative Factors					
Days in ICU	*5*	*519*	*IV, Random*	**1.06 (0.39, 1.73)*	*60%*

Table IV: Meta -Analysis of Risk Factors. * indicate statistically significant (p<.05). OR- Odds Ratio, *MD – Mean Difference,* I^2 – Higgins I^2 measurement of heterogeneity, Hb – Haemoglobin, eGFR – estimated glomerular filtration rate, M-H – Mantel–Haenszel, IV – Inverse-Variance.

Supplementary Table I Validated delirium assessment tools used in included papers

Tool	Description	Criteria
DSM-IV[5] (DSM-V is the updated version of the DSM criteria, but is not yet used widely)	Standard for diagnosis of delirium. Should meet all of the features described	Disturbance of consciousness with reduced ability to focus, sustain or shift attention Change in cognition or development of a perceptual disturbance that is not better accounted for by a dementia The disturbance develops over a short period of time and tends to fluctuate during the course of the day There is evidence from the history, physical examination or laboratory findings that the disturbance is caused by the direct physiological consequences of a general medical condition
Confusion Assessment Method[7]	Based on DSM criteria. Two primary criteria required for diagnosis plus one of a further two	Acute onset and Fluctuating course and Inattention Plus Disorganized speech or Altered level of consciousness
Delirium Rating Scale[8]	6-point clinician-rated scale in two sections	First section comprises a three-item diagnostic section. The second section scores

		severity based on 13 items
Neecham Confusion Scale[9]	0–19 points, moderate to severe confusion 20–24 points, mild or early delirium 25–30 points, normal	Level of responsiveness–information processing Attention and alertness (0–4) Verbal and motor response (0–5) Memory and orientation (0–5) Level of behaviour General behaviour and posture (0–2) Sensory motor performance (0–4) Verbal responses (0–4) Vital functions Vital signs (0–2) Oxygen saturations (0–2) Incontinence (0–2)
Delirium Observation Scale[10]	13 domains 0 points, never 1 point, sometimes or always *Scored inversely	Dozes during conversation or activities Is easy distracted by stimuli from the environment Maintains attention to conversation or action* Does not finish question or answer Gives answers which do not fit the question Reacts slowly to instructions

		Thinks to be somewhere else Knows which part of the day it is* Remembers recent event* Is picking, disorderly, restless Pulls intravenous tubes, feeding tubes, catheter, etc. Is easily or suddenly emotional Sees people/things as somebody/thing else

Supplementary Table II: Univariate analysis of risk factors

+ (increased delirium risk), = (not significant), - (decreased delirium risk)

	Benoit 2005	Bohner 2003	Bryson 2011	Ellard 2014	Katznelson 2009	Koebrugge 2010	Pol 2011	Pol 2014	Raats 2015	Salata 2012	Sasajima 2000	Sasajima 2012	Schnieder 2002	Sugimoto 2015	Van Eilsden	Visser 2015
Demographics																
Mean height	=	+														
Mean Weight	=	=														
Gender	=				=	=	=	=	=		+	+		=	=	=
Age	=	+		+	+	+	=	=	+		+	+	=	+	+	+
Total years of education	=															
Maritial status	=															
Living status (alone or not)	=								=							
BMI						=					=	=				=
Nursing help at home									=						=	
Nursing home resident									+						+	
Pre op Measurements																
Systolic BP	=					=										

Diastolic BP	=				+											
Heart rate					=											
WCC		=								+						
Platelets		=								=						
LFTs		=														
Creatinine		=		=	=								=			
Urea		=			+					=	+		+			
Protein		=														
Coagulation		=														
Glucose		=														
Sodium		=								=	=					
Potassium		=								=	=					
Calcium		=														
Haemoglobin		+		+	=	=	=			=	=	=		+	=	
ATIII		+														
CRP		+				=									+	
APOE gene			=													
eGFR<60						+	=	=						=	=	
Leukocyte count						=										
Median AP										+	+					
TP<6.0										=	=					
Albumin<3.8										+	+					

A/G<1.31					=	+			
T-CHO>240					=				
CPK>195					=				
Cl<96 or >110					=	=			
FEV1							+		
%VC							+		
Ejection Fraction %							=		
Past Medical History									
History of head injury	=								
Neurological comorbidity	=		+	+	=	=	+	=	=
No of psychoactive medications	=								
No of vasoactive medications	+								
Peripheral Vascular Disease		=							

History of POD	=				+				+		
Hypercholesteroleamia	-	=	=		=			-	+		
Hearing Impairment									=		
Visual Impairment	=								+		
Previous Vascular surgery	+										
Major amputation	+										
Femoral neck fracture	+										
Psychiatric Disease	=										
Beta Blocker use		+	=								
Diabetes			=		=	=	=	=	=	+	
Hypertension			=		=	=	=	=	=	+	
IHD			=					=			
Depression			+	+						=	

No of diagnosis	=							
No of medications	=							
Cognitive Impairment		+	+					+
Cardiac Comorbidity			+		=		+	
Pulmonary comorbidity			=				=	
COPD						=		=
Active Malign Neoplasm			=					
Non active malign neoplasm			=					
Severity of Ischemia (Claudication Vs CLI)				+	+			
Type of occlusion				=	+			

| | | |

| | | |

Amputation				+									=	
Aorto-illiac occlusive disease					+									
Type of bypass										=				
Laparotomy/Endovascular					=									
Type of operation (Aortic Vs Non-Aortic)		+												
Emergency/Elective			+		+									
Type of Anaesthesia			=		=					=		=	=	=
Renal artery clamping												=		
Type of AAA procedure	=	=			=									
Crystalloid volume		+			+						+			
Blood loss		+			+						=	+		+

Autotransfusion				=	
Minimal temp	+				
Minimal Hb	+	+		=	
Minimal pH	+				
Minimal base excess	+				
Minimal sodium	+				
Minimal potassium	+				
Minimal CVP	+				
Length of anaesthesia	=				+
Intra op BP	=*				
Intra op ABG	=*				
Intra op Glucose	=*				
Intra op additional Ca	+				
Intra op Atropine	+				

Lowest systolic BP				=								
Lowest diastolic BP				=								
Heart rate				+								
Intra op blood transfusion								=	+	+		
Minimal Pao2										=		
Sodium Bicarbonate										+		
Post-Operative Factors												
Admitted to ICU					+	+					=	
Days in ICU	=	+		+				+		=	=	
Days in Hospital	=	+	+	+	+						+	
Need for transfusion		+									=	
ABGs		=*										
Need for FFP		+										
Removed cannula or catheter		+										

Cannula or catheter infection	+							
Reintubation	+							
Need for resus	+							
Redo surgery	+					=		
Unstable hypertension	+							
Post op Hb	+		=				+	=
Minimal Platelets	+							
Total protein	+							
B blocker use		=						
Urea at discharge			=					
Creatinine at discharge			=					
No of complications			+	=				
Mortality			+					
CRP				+				
Cardiac complication								=

Pulmonary complication	=
Neurological, renal or urinary complication	+
Wound infection	=
Re-bleeding requiring intervention	=
Wound dehiscence	=
New NH resident at discharge	=

Supplementary Table III - Meta-Analysis of Risk Factors

Outcome or Subgroup	**Studies**	**Participants**	**Statistical Method**	**Effect Estimate OR[95%CI]/*MD(95%CI)***	**I^2**
Patient Demographics					
Mean Age	*10*	*2226*	*IV, Fixed*	**4.99 (4.02, 5.95)*	*0%*
Male	11	2777	M-H, Fixed	*1.30 [1.01, 1.67]	0%
Height	*2*	*255*	*IV, Fixed*	**-2.38 (-4.60, -0.16)*	*0%*
Weight	*2*	*255*	*IV, Fixed*	*-3.06 (-6.84, 0.73)*	*0%*
Lives Alone	2	308	M-H, Fixed	1.29 [0.70, 2.38]	17%
Mean BMI	*2*	*217*	*IV, Fixed*	*0.68 (-0.36, 1.71)*	*19%*
Nursing Home Resident	2	298	M-H, Fixed	*5.69 [2.77, 11.68]	0%
Pre-Op Measurements					
Pre-op Systolic BP (mmHg)	*2*	*209*	*IV, Random*	*-3.17 (-14.55, 8.22)*	*63%*
Pre op Diastolic BP (mmHg)	*2*	*209*	*IV, Random*	*-2.38 [-8.26, 3.50]*	*54%*
Mean Pre-Op Hb (g/dl)	*4*	*889*	*IV, Fixed*	**-0.66 (-0.98, -0.33)*	*0%*

Past Medical History					
Daily Use of Alcohol	2	298	M-H, Random	0.44 [0.10, 1.82]	61%
Current Smoker	3	771	M-H, Random	1.71 [0.56, 5.25]	79%
Any Time Smoker	3	1013	M-H, Random	1.42 [0.65, 3.08]	58%
eGFR<60	5	1180	M-H, Fixed	*2.09 [1.23, 3.56]	0%
Neurological Comorbidity	4	699	M-H, Fixed	*1.57 [1.06, 2.31]	0%
History of Delirium	2	298	M-H, Fixed	*7.49 [3.25, 17.28]	0%
Visual Impairment	2	245	M-H, Fixed	*2.16 [1.25, 3.74]	0%
Beta Blocker Use Pre Op	2	1082	M-H, Fixed	*1.70 [1.21, 2.39]	0%
Hypercholesterolaemia	4	848	M-H, Fixed	*0.40 [0.27, 0.59]	0%
Statin Use	2	994	M-H, Fixed	*0.73 [0.54, 0.97]	0%
History of CVA/TIA	4	1552	M-H, Fixed	*1.87 [1.31, 2.67]	48%
Diabetes	7	2149	M-H, Random	1.40 [0.86, 2.27]	69%
Hypertension	7	2149	M-H, Fixed	1.25 [0.95, 1.64]	48%
Ischaemic Heart Disease	2	979	M-H, Random	0.99 [0.35, 2.85]	85%
Depression	3	1306	M-H, Fixed	*2.82 [1.59, 4.99]	27%
Cognitive Impairment	3	946	M-H, Fixed	*6.52 [3.39, 12.53]	19%
Cardiac Comorbidity	3	597	M-H, Random	2.43 [0.97, 6.12]	76%

Pulmonary Comorbidity	2	298	M-H, Random	0.95 [0.30, 2.99]	61%
COPD	2	860	M-H, Fixed	1.42 [0.67, 3.02]	0%
End Stage Renal Disease	2	696	M-H, Fixed	2.01 [1.00, 4.05]	0%
Scoring Systems					
ASA Score	*3*	*307*	*IV, Fixed*	**0.14 (0.01, 0.26)*	*47%*
ASA>2	5	1180	M-H, Fixed	*3.44 [2.02, 5.87]	49%
HAMD	*2*	*200*	*IV, Fixed*	**3.12 (1.64, 4.60)*	*0%*
BPRS	*2*	*200*	*IV, Fixed*	**4.79 (2.46, 7.11)*	*0%*
ASGS	*2*	*200*	*IV, Fixed*	**0.79 (0.50, 1.08)*	*0%*
GAS	*2*	*200*	*IV, Fixed*	**-9.58 (-13.34, -5.81)*	*0%*
MMSE	*2*	*200*	*IV, Fixed*	**-1.36 (-2.08, -0.64)*	*0%*
CCI	*3*	*526*	*IV, Fixed*	**1.21 (0.80, 1.61)*	*25%*
SNAQ≥3	2	291	M-H, Fixed	*2.26 [1.15, 4.43]	0%
HDS-R≤20	2	409	M-H, Fixed	*0.31 [0.18, 0.54]	0%
Peri/Post-Operative Factors					
Emergency Operation	2	607	M-H, Random	*4.09 [1.09, 15.33]	82%

Elective Operation	2	607	M-H, Random	0.24 [0.07, 0.92]	82%
General Anaesthesia	5	1461	M-H, Fixed	0.94 [0.69, 1.29]	46%
Regional Anaesthesia	2	970	M-H, Fixed	1.36 [0.76, 2.41]	0%
Admission to ICU	3	511	M-H, Fixed	*2.61 [1.28, 5.33]	0%
Days in ICU	*5*	*519*	*IV, Random*	**1.06 (0.39, 1.73)*	*60%*
Days in Hospital	*3*	*362*	*IV, Random*	*8.68 (-2.68, 20.05)*	*92%*
Early Redo Surgery	2	452	M-H, Random	0.89 [0.11, 7.17]	77%
Minimal Post Op Hb (g/dl)	*2*	*200*	*IV, Fixed*	**-1.30 (-1.79, -0.81)*	*0%*
Minimal Day 1 Post Op Hb (g/dl)	*2*	*260*	*IV, Fixed*	*-0.28 (-0.73, 0.16)*	*0%*
No of Complications	*2*	*384*	*IV, Random*	*1.29 (-0.67, 3.25)*	*96%*
Length of Op (min)	*4*	*472*	*IV, Fixed*	*16.09 (-0.98, 33.17)*	*48%*
Aortic Cross Clamp Time (min)	*2*	*255*	*IV, Fixed*	**8.11 (2.05, 14.17)*	*0%*
Blood Loss (ml)	*3*	*307*	*IV, Fixed*	**992.57 (558.95, 1426.19)*	*0%*

Minimal Intra-op Hb (g/dl)	*2*	*200*	*IV, Fixed*	**-1.46 (-2.12, -0.79)*	*0%*
Intra Op Blood Transfusion	2	409	M-H, Fixed	*2.44 [1.58, 3.76]	0%

Supplementary Table II: Meta -Analysis of Risk Factors. *($p<0.05$). OR- Odds Ratio, *MD – Mean Difference,* I^2 – Higgins I^2 measurement of heterogeneity. BMI – body mass index, BP – blood pressure, Hb – Haemoglobin, eGFR – estimated glomerular filtration rate, COPD – chronic obstructive pulmonary disease, HAMD - Hamilton Depression Scale, BPRS - Brief Psychiatric Rating Scale, ASGS - General Severity Score, MMSE - Mini-Mental-State-Examination, GAS - Global Assessment Scale, CCI – Charlson Comorbidity Index, M-H – Mantel–Haenszel, IV – Inverse-Variance.